

Course Code	Course Title	L	T	P	C
1152EC241	Software Defined Networking	2	0	2	3

a) Course Category

Program Elective

b) Preamble

This course introduces about software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network.

c) Prerequisite

Data Communication Networks

d) Related Courses

Network Management, Internet of Things

e) Course Outcomes

On successful completion of the course, the students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the key benefits of SDN by the separation of data and control planes	K2
CO2	Interpret the SDN data plane devices and Openflow Protocols	K2
CO3	Implement the operation of SDN control plane with different controllers	K2
CO4	Apply techniques that enable applications to control the underlying network using SDN	K2
CO5	Describe Network Functions Virtualization components and their roles in SDN	K2

f) **Correlation of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	-	L	-	-	L	-	-	-	-	-	-	-	-
CO2	M	-	L	-	-	-	-	-	-	-	-	L	-	-
CO3	L	L	L	-	-	-	-	-	-	-	-	-	-	-
CO4	L	-	M	-	M	-	-	-	-	-	-	-	-	-
CO5	L	M	-	L	L	-	-	-	-	-	L	L	-	-

g) **Course Content**

UNIT I SDN BACKGROUND AND MOTIVATION 9

Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

UNIT II SDN DATA PLANE AND OPENFLOW 9

SDN data plane: Data plane Functions, Data plane protocols, Openflow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table- OpenFlow Protocol.

UNIT III SDN CONTROL PLANE 9

SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- OpenDaylight-REST- Cooperation and Coordination Among Controllers.

UNIT IV SDN APPLICATION PLANE 9

SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring- Security- Data Center Networking- Mobility and Wireless.

UNIT V NETWORK FUNCTIONS VIRTUALIZATION 9

Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements- NFV Reference Architecture: NFV Management and Orchestration.

h) Practical Exercises 15

The Experiments using Mininet

- 1 Network Topology creation and REST API introduction.
- 2 Influencing flows via cURL commands.
- 3 Create a network and run a simple performance test.
- 4 Use “ovs-vsctl” command to directly control open v switch.
- 5 Dynamically change the network parameters—link delay analysis.
- 6 Dynamically change the forwarding rules.
- 7 Mininet Random Topology Generator.

Total 60 Hrs

i) Learning Resources

Text Books

1. William Stallings, “Foundations of Modern Networking”, Pearson Ltd.,2016.
2. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black,Morgan Kaufmann Publications, 2014
3. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013

Reference Books

1. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.
2. Kreutz, Diego, et al. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 (2015): 14-76.

Online Resources

1. <https://www.coursera.org/learn/sdn>